

# Kruger National Park Rivers

## LiDAR Project Survey Report

**SGP2012\_24**



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## **Project Detail, Overview and Equipment**

### **Project Detail**

**Survey Project:** Kruger National Park 3 Rivers.

**Date of Survey:** 30 May 2012.

**Client:** University of Gloucestershire.

### **Project Overview**

The topographical survey was undertaken by Southern Mapping Geospatial (SMG) to produce rectified colour images and a digital terrain model (DTM) of the project area.

The topographical survey was carried out using an aircraft mounted LiDAR system that scanned the ground below at 70 kHz, resulting in a dense DTM of the ground surface and objects above the ground.

Digital colour images were also taken from the aircraft and rectified to produce colour orthophotos of the project area.

The survey was flown at a height of about 1100m and an orthoimage pixel size of 15cm has been produced.

### **Equipment Used**

**Aircraft:** Cessna 206.

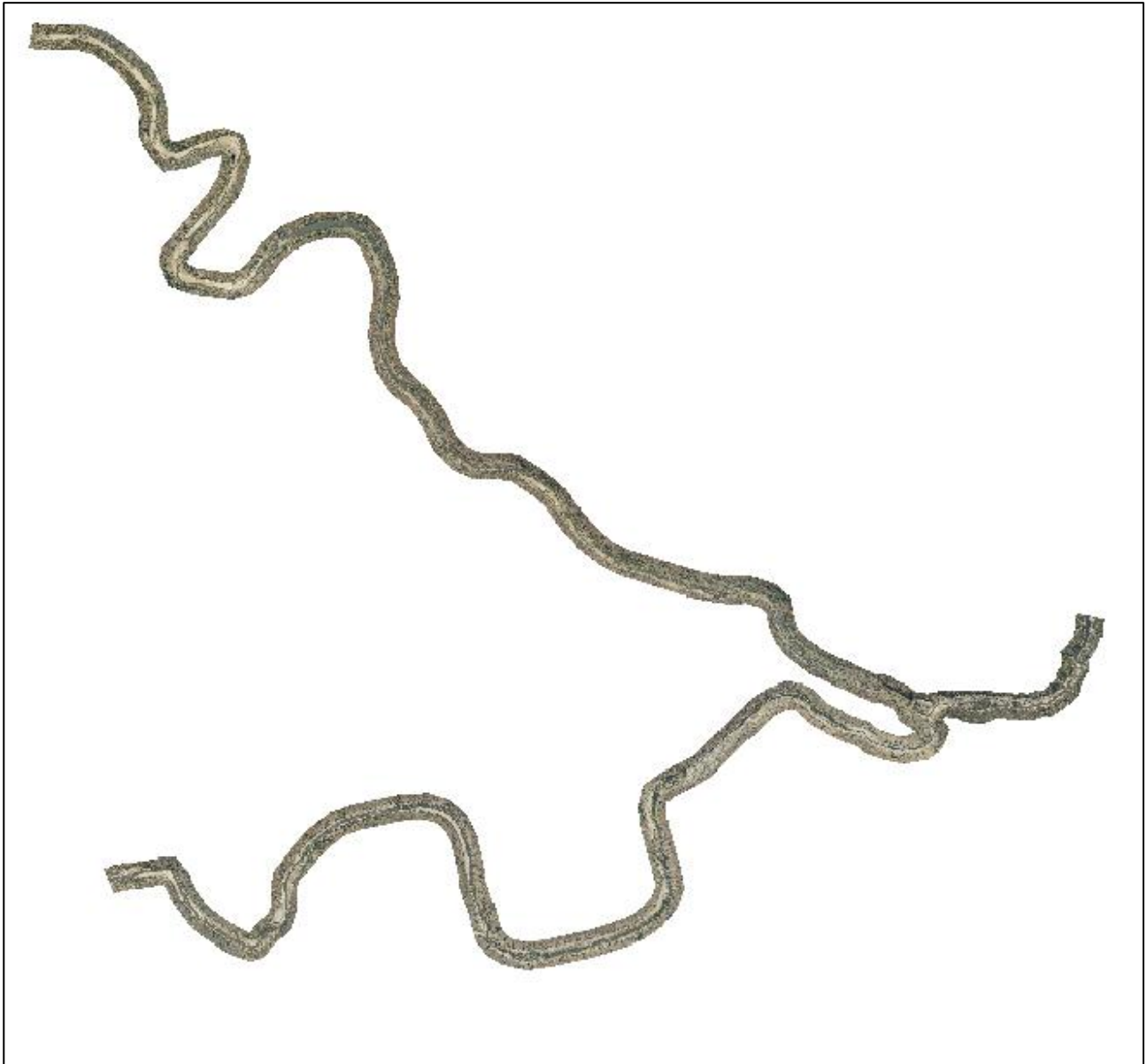
**LiDAR Scanner:** Optech Orion M200.

**Camera:** Rollei AIC with a 60 mega-pixel P65+ Phase One digital CCD.



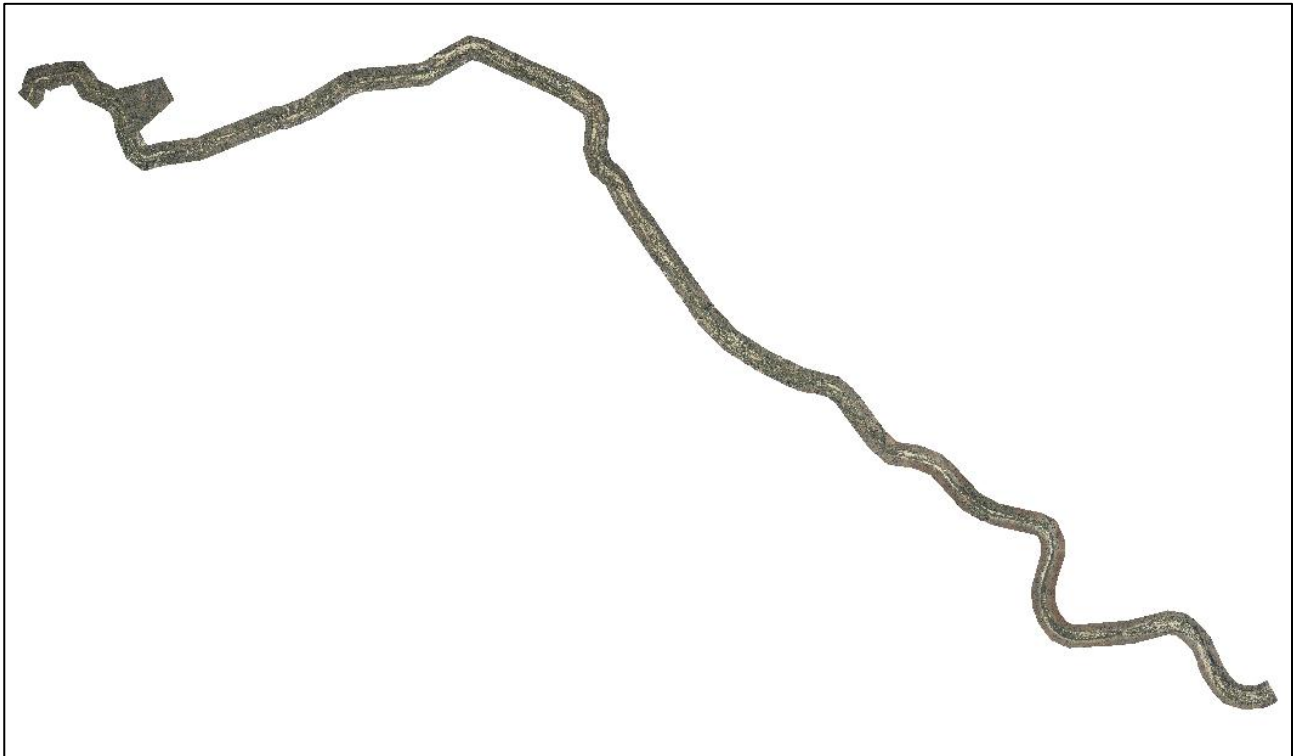
## **Project Extent**

The project extent covers an area of approximately 15599 Ha.



Ortho Imagery of Letaba and Olifants River.





Ortho Imagery of the Sabie River.



## Check Points

### Check Points

Five Check points were placed in the area based on Trignet.

#### WGS84 UTM36S

Name	Easting	Northing	Orthometric Height (SAG2010)
SMG122401	358 013.95	7 237 698.47	299.19
SMG122402	370 389.97	7 239 621.69	231.81
SMG122403	390 345.24	7 221 719.32	169.84
SMG122404	374 717.70	7 346 798.56	160.03
SMG122405	364 485.58	7 343 239.07	230.48

## LiDAR Point Processing, Calibration, Transformations and Editing

### LiDAR Point Processing

The trajectory for each flight was post processed using *Waypoint DGPS* software, which combines the 1 Hz GPS readings with the 200Hz inertial measurement system (IMU) readings and outputs a smoothed “best estimated” trajectory for the laser scanner and camera positions.

### LiDAR Calibration

Overlapping LiDAR points from adjacent aircraft trajectories were used to check the LiDAR calibration for heading, roll, pitch and scale.

These values were then used to make small flight-specific adjustments to the LiDAR data.

### LiDAR Point Transformations

The LiDAR points were initially calculated based on the ITRF2008 datum with ellipsoidal heights. The LiDAR points were then converted from Hartebeesthoek94 using the following calculated shifts based on the TrigNET values.

#### **Sabie River Gauss Conform 31**

Name	Easting	Northing	Reference System
NSPT	2497.06	2 818 710.89	Hart94 (WGS84)
NSPT	2496.74	2 818 710.50	ITRF2008
Differences	0.32	0.39	

#### **Letaba and Olifants River Gauss Conform 31**

Name	Easting	Northing	Reference System
PBWA	-13 673.09	2 649 924.35	Hart94 (WGS84)
PBWA	-13 673.31	2 649 923.91	ITRF2008
Differences	0.22	0.44	

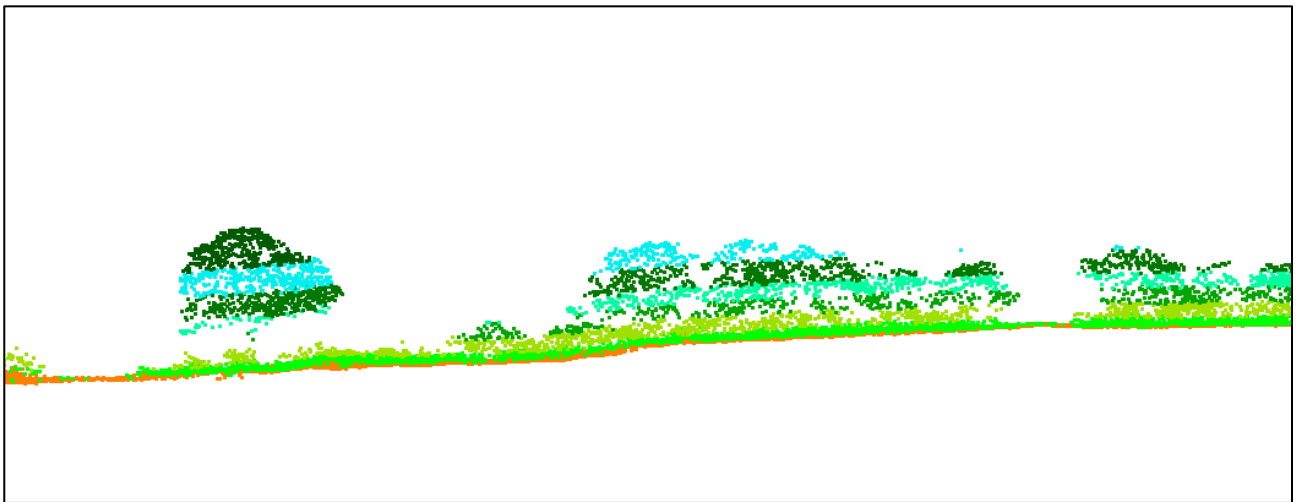




The Hartebeesthoek94 ellipsoidal heights were then converted to Orthometric heights using the SAG2010 Geoid model in *TerraScan* software.

### **LiDAR Point Editing**

A “1<sup>st</sup> run” automatic classification was carried out on the raw LiDAR points using *TerraSolid’s TerraScan* software to separate the LiDAR points into ground hits and non-ground hits. This results in a greater than 90% correct classification. After this, a manual classification was done over the required area to edit the points with gross classification errors that may have occurred in the automatic classification process. The above ground class was further classified into the requested vegetation height classes.



Vegetation classified according to height from ground.



## **Orthophoto Rectification Procedure**

Images were rectified by identifying common pixel points in overlapping image tiles using a process known as "tie-pointing".

After completion of the "tie-point" process all images were adjusted for optimum heading, roll, pitch and scale values so as to ensure a seamless image mosaic was obtained.



Rectified Image.



## Checkpoints and Accuracies

### Vertical accuracy

#### WGS84 UTM36S

Name	Easting	Northing	Known Z at Ground Level	LIDAR Z	Dz
SMG122401	358 013.95	7 237 698.47	299.19	299.14	-0.05
SMG122402	370 389.97	7 239 621.69	231.81	Removed	Removed
SMG122403	390 345.24	7 221 719.32	169.84	169.89	+0.05
SMG122404	374 717.70	7 346 798.56	160.03	160.01	-0.02
SMG122405	364 485.58	7 343 239.07	230.48	230.49	+0.01
Average Dz	0.00				
Minimum Dz	-0.05				
Maximum Dz	+0.05				
Average magnitude	0.03				
Root mean square	0.04				
Std deviation	0.04				

**Note:** Point SMG122402 was removed from the results because the point is on uneven ground and a reliable comparison therefore could not be done.



### **Horizontal Accuracy**

Pre-marked control/check points were digitized on the orthophotos and the derived coordinates were compared with the ground survey values:

The known point comparison results are as follows:

#### **WGS84 UTM36S**

<b>Name</b>	<b>Orthophoto Easting</b>	<b>Orthophoto Northing</b>	<b>Known Easting</b>	<b>Known Northing</b>	<b>Dx(m)</b>	<b>Dy(m)</b>
SMG122401	358013.88	7237698.45	358 013.95	7 237 698.47	-0.07	-0.02
SMG122402	370389.93	7239621.58	370 389.97	7 239 621.69	-0.04	-0.11
SMG122403	390345.30	7221719.32	390 345.24	7 221 719.32	0.06	0.00
SMG122404	374717.65	7346798.59	374 717.70	7 346 798.56	-0.05	0.03
SMG122405	364485.50	7343239.12	364 485.58	7 343 239.07	-0.08	0.05
<b>Average from known position</b>					<b>-0.04</b>	<b>-0.01</b>
<b>Standard Deviation</b>					<b>0.05</b>	<b>0.06</b>
<b>Root Mean Square</b>					<b>0.06</b>	

## Deliverables

1. CAD design files in Microstation DGN and AutoCAD DWG formats showing:
  - i. Orthophoto tiles layout.
  - ii. LiDAR point layout.
  - iii. Contours at 0.5m, 1m and 2m intervals.
  - iv. The project area surveyed with boundaries.

*\*These contours have been smoothed and are merely an aesthetic representation of the ground shape.*

2. Ortho-rectified images, according to the block index, in ECW format with a pixel resolution of 0.15m.
3. Ground Points and Vegetation points.  
Non Ground points were classified into the requested vegetation classes based on height above ground.  
The file format is a comma delimited text file with the following columns:  
**Easting ,Northing ,Height ,Intensity**
4. This project report.

## Queries

If you have any queries, please do not hesitate to contact:

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